

CLAIMS:

1. An apparatus capable of actuating a valve of an internal combustion engine according to a first stroke function and a second stroke function, which is different from the first stroke function, comprising:

a pivot lever mounted so as to be pivotable about an axis that is stationary relative to the engine, the pivot lever having an abutment element displaced from the axis, wherein the pivot lever is arranged and constructed to be pivoted about the axis by a reciprocating actuating device that is moved by a rotating element of the engine,

an intermediate lever pivotably disposed on the pivot lever,

a valve lever pivotably disposed with respect the intermediate lever, the valve lever being arranged and constructed to reciprocally move the valve according to the first stroke function or the second stroke function, wherein the valve lever comprises an abutment surface arranged and constructed to abut the abutment element, and

a locking device arranged and constructed to be actuated so as to fixedly couple the intermediate lever to one of the pivot lever or the valve lever, wherein the apparatus is arranged and constructed such that:

(i) when the locking device is actuated to fixedly couple the intermediate lever to one of the pivot lever and the valve lever, pivotal movement of the pivot lever is transferred to the valve lever without the pivot lever pivoting relative to the valve lever, wherein the valve is actuated according to the first stroke function, and

(ii) when the locking device is actuated to decouple the intermediate lever from one of the pivot lever and the valve lever, pivotal movement of the pivot lever is transferred to the valve lever by a combination of the pivot lever pivoting relative to the valve lever and the abutment element moving along the abutment surface, wherein the valve is actuated according to the second stroke function.

2. An apparatus according to claim 1, wherein the locking mechanism comprises a locking element arranged and constructed to engage the intermediate lever so as to fixedly couple the pivot lever with the intermediate lever and to disengage from the intermediate lever so as to permit the pivot lever to pivot relative to the intermediate lever.

3. Apparatus according to claim 1, wherein:

the intermediate lever is generally U-shaped with a pair of parallel arms connected by a crosspiece, wherein a locking hole is defined within the crosspiece and the pivot lever is accommodated within the parallel arms, and

the locking element includes a projection that engages the locking hole in order to fixedly couple the pivot lever with the intermediate lever,

and further comprising:

a spring disposed between the pivot lever and the intermediate lever, which spring biases the pivot lever, relative to the intermediate lever, towards the reciprocating actuation member.

4. An apparatus according to claim 3, wherein the valve lever is disposed between the parallel arms of the intermediate lever and is supported via a hydraulic valve play-compensating element on a valve stem of the valve.
5. An apparatus according to claim 1, wherein the abutment element comprises a roller that is adapted to roll along the abutment surface of the valve lever when the pivot lever is pivotable with respect to the intermediate lever.
6. An apparatus according to claim 1, wherein the second stroke function lies within the first stroke function.
7. An apparatus according to claim 1, wherein the locking device comprises a piston, which is movable into a hydraulic cylinder disposed in the pivot lever and the hydraulic cylinder is arranged and constructed to be pressurized with different hydraulic pressures so as to lock and unlock the pivoting movement of the intermediate lever.
8. An apparatus according to claim 7, further comprising hydraulic fluid supply ducts for supplying lubrication of bearing surfaces and to the hydraulic valve play-compensating element.
9. An apparatus according to claim 1, wherein the reciprocating actuating element comprises a push rod that is linearly movable by contacting a rotating camshaft or crankshaft of the engine.

10. An apparatus according to claim 9, wherein the push rod comprises a hydraulic fluid supply duct.

11. An apparatus according to claim 1, further comprising a bearing pin defining the axis that is stationary relative to the pivot lever, wherein the bearing pin extends through and supports the pivot lever and the intermediate lever is supported on the outside of the pivot lever.

12. An apparatus according to claim 1, wherein the second stroke function defines a valve opening distance and a valve opening duration that are less than a valve opening distance and a valve opening duration of the first stroke function.

13. An apparatus according to claim 1, wherein:

the intermediate lever is generally U-shaped with a pair of parallel arms connected by a crosspiece and is supported on the outside of the pivot lever, wherein a locking hole is defined within the crosspiece and the pivot lever is accommodated within the parallel arms, and

the locking device comprises a piston that is movable upon application of a hydraulic pressure thereto so as to engage the locking hole and thereby fixedly couple the pivot lever to the intermediate lever,

the valve lever is disposed between the parallel arms of the intermediate lever and is supported via a hydraulic valve play-compensating element on a valve stem of the valve,

the abutment element comprises a roller that is adapted to roll along the abutment surface of the valve lever when the pivot lever is pivotable with respect to the intermediate lever,

the reciprocating actuating element comprises a push rod that is linearly movable by contacting a rotating camshaft or crankshaft of the engine,

and further comprising

a bearing pin defining the axis that is stationary relative to the pivot lever, wherein the bearing pin extends through and supports the pivot lever and the intermediate lever is supported on the outside of the pivot lever, and

a spring disposed between the pivot lever and the intermediate lever, which spring biases the pivot lever, relative to the intermediate lever, towards the push rod.

14. An apparatus according to claim 13, wherein the second stroke function defines a valve opening distance and a valve opening duration that are less than a valve opening distance and a valve opening duration of the first stroke function.

15. A method for actuating a valve of an internal combustion engine, wherein the valve is arranged and constructed to control the flow of a fluid into and out of a combustion cylinder, the method comprising:

locking an intermediate lever of a valve actuating device to one of a pivot lever and a valve lever of the valve actuating device,

reciprocally pivoting the pivot lever, the intermediate lever and the valve lever about a pivotal axis, wherein pivotal movement of the pivot lever is transferred to the valve lever without the pivot lever pivoting relative to the valve lever and the valve is actuated according to a first stroke function,

releasing the intermediate lever from said one of the pivot lever and the valve lever, and

reciprocally pivoting the pivot lever, the intermediate lever and the valve lever about the pivotal axis, wherein pivotal movement of the pivot lever is transferred to the valve lever by a combination of the pivot lever pivoting relative to the valve lever and an abutment element of the pivot lever moving along an abutment surface of the valve lever and the valve is actuated according to a second stroke function, the second stroke function having a shorter valve opening duration than the first stroke function and the second stroke function having a smaller maximum stroke than the first stroke function.

16. An apparatus for actuating a valve of an internal combustion engine, wherein the valve is arranged and constructed to control the flow of a fluid into and out of a combustion cylinder, the apparatus comprising:

an intermediate lever, a pivot lever and a valve lever,

means for selectively locking the intermediate lever to one of the pivot lever and the valve lever, such that when the intermediate lever is locked to said one of the pivot lever and the valve lever, pivotal movement of the pivot lever is transferred to the valve lever without the pivot lever pivoting relative to the valve lever and the valve is actuatable according to a first stroke function, and such that when the intermediate lever is unlocked from said one of the pivot lever and the valve lever, pivotal movement of the pivot lever is transferred to the valve lever by a combination of the pivot lever pivoting relative to the valve lever and an

abutment element of the pivot lever moving along an abutment surface of the valve lever and the valve is actuatable according to a second stroke function, and

means for reciprocally pivoting the pivot lever, the intermediate lever and the valve lever about a pivotal axis, wherein the second stroke function has a shorter valve opening duration than the first stroke function and the second stroke function has a smaller maximum stroke than the first stroke function.